

# TAXONOMY OF HYMENOXYS SUBGENUS MACDOUGALIA (ASTERACEAE: HELENIEAE: TETRANEURINAE)

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## ABSTRACT

A taxonomic treatment is presented for *Hymenoxys* subg. *Macdougalia*, which includes a single species, *Hymenoxys bigelovii*. The treatment includes a discussion of the original circumscription of *Hymenoxys bigelovii* (as *Actinella bigelovii*), the later description of the genus *Macdougalia* to accommodate this taxon, and the eventual placement, based on chemical, cytological, and morphological evidence, of *Macdougalia* within *Hymenoxys* as a monotypic subgenus. The treatment also includes synonymies of *Hymenoxys* subg. *Macdougalia* and *Hymenoxys bigelovii*, lectotypification of *Actinella bigelovii*, and a description and range map for *Hymenoxys bigelovii*.

## RESUMEN

Se presenta un tratamiento taxonómico de *Hymenoxys* subg. *Macdougalia*, que incluye una sola especie, *Hymenoxys bigelovii*. El tratamiento incluye una discusión de la circunscripción original de *H. bigelovii* (como *Actinella bigelovii*), la descripción del género *Macdougalia* para acomodar este taxon, y la colocación eventual, basada en pruebas químicas, citológicas, y morfológicas, de *Macdougalia* en *Hymenoxys* como un subgénero monotípico. El tratamiento incluye también sinonimias de *Hymenoxys* subg. *Macdougalia* y *Hymenoxys bigelovii*, lectotipificación de *Actinella bigelovii*, y una descripción y mapa de distribución de *Hymenoxys bigelovii*.

*Hymenoxys* Cass. subg. *Macdougalia* (A. Heller) Bierner comprises only one species, *Hymenoxys bigelovii* (A. Gray) K.L. Parker. This taxon was originally described as *Actinella bigelovii* A. Gray, *Actinella* Pers. being the generic name commonly used at that time (e.g., Torrey & Gray 1842) for taxa now placed in *Tetraneuris* Greene and *Hymenoxys*. When describing *Actinella bigelovii*, Gray (1853) made no comments that would indicate any hesitation on his part as to its placement in *Actinella*.

Later (1883), when Gray positioned *Actinella bigelovii* in *Actinella* section *Hymenoxys*, he commented, "Connects [section] *Hymenoxys* with [section] *Euactinella*, and with section *Dugaldea* [sic] of *Helenium*." This statement indicates to me that Gray may not have been completely comfortable with his placement of this taxon. His section *Hymenoxys* equates today with *Hymenoxys* subg. *Hymenoxys*, *Hymenoxys* subg. *Phileozera* (Buckley) Cockerell (in part), and *Hymenoxys* subg. *Picradenia* (Hook.) Cockerell (Bierner 2001), his section *Euactinella* equates today with *Tetraneuris*, *Hymenoxys* subg. *Phileozera* (in

part), and *Hymenoxys* subg. *Rydbergia* (Greene) Bierner (Bierner 2001; Bierner & Turner 2003), and his section *Dugaldea* [sic] of *Helenium* equates today with *Hymenoxys* subg. *Dugdaldia* (Cass.) Bierner (Bierner 2001).

Heller (1898) seems to have been even less sure about its placement, as indicated by his comment, "In habit it is more like the genus *Tetraneuris*, but has a different involucre, and while its involucre is somewhat similar to that of the genus *Picradenia* [= *Hymenoxys* subg. *Picradenia*], there is a wide difference in habit." His solution was to describe the genus *Macdougalia* to accommodate this one taxon, a circumscription followed by Cockerell (1904), Rydberg (1915), and Robinson (1981). Other workers, such as Turner and Powell (1977) and Karis and Ryding (1994), felt there was no clear basis for maintaining *Macdougalia* as a separate genus and submerged it in *Hymenoxys*.

Spring et al. (1994) began their study of chemical components of glandular trichomes in *Hymenoxys* and related genera by recognizing *Macdougalia* as a genus separate from *Hymenoxys*. By the end of the study they were of the opinion, based on sesquiterpene lactone and monoterpene glycoside chemistry, that *Macdougalia* should be incorporated into a broader concept of *Hymenoxys*. Likewise, Bierner and Jansen (1998), who began their study of DNA restriction site variation in *Hymenoxys* and related genera recognizing *Macdougalia* as a distinct genus, concluded that it is in fact congeneric with *Hymenoxys*. The relationship of *Macdougalia* to *Hymenoxys* is further supported by similarities of flavonoid chemistry (e.g., Wagner et al. 1972) and chromosome number,  $2n = 30$  being the chromosome number of *H. bigelovii* (Speese & Baldwin 1952; Strother 1966; Bierner unpublished and Parker & McClintock unpublished—see representative specimens) and the predominant number among the diverse taxa of *Hymenoxys* (e.g., Speese & Baldwin 1952; Beaman & Turner 1962; Strother 1966; Sanderson 1973; Turner et al. 1973). In 2001, Bierner formally recognized *Macdougalia* as a subgenus of *Hymenoxys*.

While Spring et al. (1994) were confident about the association of *Macdougalia* with *Hymenoxys*, they were less sure about its relationship to other taxa within *Hymenoxys*. The phenogram prepared from sesquiterpene lactone data placed *H. bigelovii* (as *Macdougalia bigelovii*) closest to *H. hoopesii* of subg. *Dugdaldia* and *H. rusbyi* of subg. *Picradenia*. The strict consensus tree prepared by Bierner and Jansen (1998) placed *H. bigelovii* (as *Macdougalia bigelovii*) in the clade containing taxa of *Hymenoxys* subg. *Dugdaldia*, *Hymenoxys* subg. *Picradenia*, and *Hymenoxys* subg. *Plummera*, but no clear association with any species in particular was apparent.

Morphology also supports the placement of *Macdougalia* in *Hymenoxys*. The stems, peduncles, receptacles, ray florets, and disc florets of *Hymenoxys bigelovii* are very similar to those of the *Hymenoxys* species in general. Conversely, a substantial number of morphological differences support the recognition of *Macdougalia* as a subgenus.

*Hymenoxys bigelovii* usually has all simple leaves that are eglandular or sparsely glandular. Among the other taxa of *Hymenoxys*, only *H. hoopesii* has all simple leaves, and only *H. texana* has leaves that are weakly to moderately glandular (all of the other taxa have distinctly glandular leaves).

As in essentially all of the perennial taxa of *Hymenoxys* (and *Tetraneris* as well), the basal leaf bases of *H. bigelovii* are persistent and tend to thicken the caudices distally as the plants age. The basal leaves of *H. bigelovii*, however, decay down to the veins so that the tops of the caudices usually appear to be encased in a stringy cocoon. I have observed this decay to the veins occasionally in other taxa of *Hymenoxys*, but it is unusual and never creates the appearance of a stringy cocoon.

The phyllaries of *Hymenoxys bigelovii* are in two unequal series, as they are in most of the taxa of *Hymenoxys* (those of subg. *Dugaldia* and subg. *Rydbergia* are in two or three subequal series). The outer phyllaries of *H. bigelovii* are basally connate only slightly to 1/5 their lengths; the outer phyllaries of the other *Hymenoxys* taxa with two unequal series (except for *H. texana*) are basally connate 1/4 to 2/3 their lengths. The inner phyllaries of *H. bigelovii* are narrowly lanceolate to narrowly obovate, have aristate apices, and very distinctly exceed the outer in length; inner phyllaries of the other *Hymenoxys* taxa with two unequal series are usually obovate, have acuminate to usually mucronate apices, and surpass the outer in length only slightly or not at all.

The relationship of *Hymenoxys bigelovii* to other taxa of *Hymenoxys* remains unclear. Its relatively large involucre (13–20 mm high by 23–32 mm wide) might suggest a connection to *H. hoopesii*, *H. brandegeei*, or *H. grandiflora*, but the phyllaries are very different. Perhaps a clue rests with some unusual populations of *H. richardsonii* var. *richardsonii* from Fremont County, Wyoming (e.g., *Fisser* 661 and 699 [RM], and *Dorn* 3516 [NY, RM]). The phyllaries look so much like those of *H. bigelovii* that I was convinced when I first saw the specimens that these plants represented an undescribed species belonging to subgenus *Macdougalia*, even though the plants had divided leaves (blades are only rarely divided into three segments in *H. bigelovii*) and were well separated geographically from *H. bigelovii*. When I was able to see them in the field, however, it was obvious that they are indeed plants of *H. richardsonii* var. *richardsonii*, but with narrower, longer, aristate inner phyllaries. Yet, this illustrated to me that it is not a long morphologic leap from the involucre of *H. bigelovii* to those of some other *Hymenoxys* species.

#### TAXONOMY

***Hymenoxys* subg. *Macdougalia*** (A. Heller) Bierner, *Lundellia* 4:39. 2001.  
*Macdougalia* A. Heller, *Bull. Torrey Bot. Club* 25:629. 1898. TYPE SPECIES: *Actinella bigelovii* A. Gray, *Pl. Wright*. 2:96. 1853. (= *Hymenoxys bigelovii*)

***Hymenoxys bigelovii*** (A. Gray) K.L. Parker, *Madroño* 10:159. 1950. BASIONYM: *Actinella*

*bigelovii* A. Gray, Pl. Wright, 2:96, 1853. TYPE: U.S.A. NEW MEXICO. Grant or Sierra Co.: "Copper Mines - on the mountains" (lectotype label), 17 Apr 1852, *Bigelow s.n.* (LECTOTYPE [per previous annotations] here designated: GH; PROBABLE ISOLECTOTYPES: NY!, US-27506!, US-27507!, US-27508!). The following notation in the protologue, "On mountains near the copper mines, and near the Mimbres, New Mexico; April, June," indicates that Gray was looking at more than one Bigelow collection when he wrote the description. Furthermore, the type sheet at GH contains three Bigelow specimens, one with the notation "Copper Mines" (far right), another with the notation "Near the Mimbres June 1852" (center), and another with the notation "Copper Mines - on the mountains, April 17, 1852." (far left). The specimen to the far left was already annotated as the lectotype when I borrowed it (no name or date on the label), and I likewise annotated it as the lectotype. I did so because there is no doubt at all that Gray was using this specimen; it is the only plant on the sheet that has cauline leaves that are divided into three segments, and the original description includes, "...foliis angustissime linearibus rigidis integerrimis paucisve caulinis trilobis..." In addition, collection information beneath the specimen includes, "*Actinella Bigelovii*, n. sp. (Pl. Wr)." The lectotype bears no collection number; specimens at NY and US that appear to be part of the type collection bear the number 637. = *Actinea bigelovii* [as *Bigelowii*] (A. Gray) Kuntze, Rev. Gen. Pl. 1:303, 1891. = *Macdougalia bigelovii* (A. Gray) A. Heller, Bull. Torrey Bot. Club 25:629, 1898. = *Actinea bigelovii* (A. Gray) A. Nelson, Univ. Wyoming Publ. Sci. Bot. 1:139, 1926, nom. superflua.

*Actinea gaillardia* A. Nelson, Univ. Wyoming Publ. Sci., Bot. 1:140, 1926. TYPE: U.S.A. ARIZONA. Coconino Co.: "Rocky hillsides, among Yellow Pine Flagstaff Ariz." (holotype label), 2 Jun 1922, *Hanson 32* (HOLOTYPE: RM-100733; PROBABLE ISOTYPE: MO-895987).

Polycarpic perennials. Caudices sparingly branched, thickened distally, usually encased in a stringy cocoon-like covering formed by the veins of the decaying leaf bases. Aerial stems 1-5, erect, usually unbranched distally, green throughout to purple-red-tinted distally to purple-red-tinted throughout, 20-70 cm, sparsely to densely pubescent, often tomentose proximally, eglandular or sparsely dotted with sessile glands. Leaves basal and cauline, alternate, linear to linear-lanceolate to linear-ob lanceolate, simple and entire or blades rarely divided into three segments, glabrous or sparsely to densely pubescent, eglandular or sparsely dotted with impressed glands; basal leaf bases expanded, clasping, persistent, sparsely to densely long-villous-woolly. Heads 1-5 per plant, usually borne singly but sometimes in panicleiform arrays. Peduncles (1.5-)6-20(-29) cm, expanded apically, moderately to densely pubescent, densely tomentose distally beneath the involucre, sparsely to moderately dotted with sessile glands. Involucre hemispheric to broadly campanulate, 13-20 × 23-32 mm. Phyllaries in 2 series; outer phyllaries 13-19, basally connate only slightly to 1/5 their lengths, green throughout or yellow to yellow-green proximally and green distally, often purple-red tinted on the margins, lanceolate to narrowly lanceolate or obovate to narrowly obovate, 7-11 × 1.3-2.8 mm, weakly to moderately keeled, apices acute to acuminate, abaxial faces sparsely to densely pubescent, sparsely to moderately dotted with sessile and impressed glands, adaxial faces glabrous or sparsely pubescent, eglandular or sparsely dotted with sessile glands; inner phyllaries 13-18, free, bodies yellow to yellow-green and scale-like, usually green distally, often purple-red tinted at the apices, narrowly

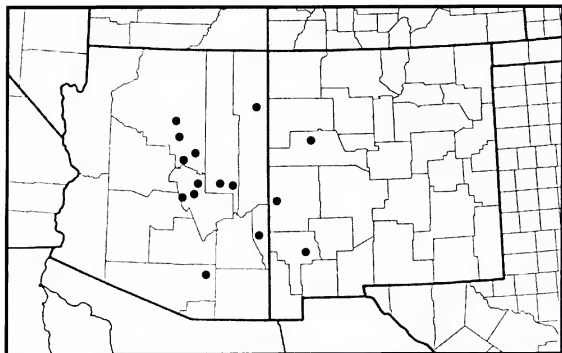


FIG. 1. Known distribution of *Hymenoxys bigelovii*.

lanceolate to narrowly obovate, 8.5-12.6  $\times$  (1.1-)1.5-2.2 mm, distinctly surpassing the outer, not keeled or weakly to moderately keeled, apices aristate, abaxial faces glabrous or sparsely pubescent, eglandular, adaxial faces glabrous, eglandular. Ray florets 13-15, pistillate, fertile; corollas yellow, extending well beyond the phyllaries, 13-26  $\times$  5.4-9.5 mm, lobes 3, abaxial faces glabrous or sparsely pubescent, eglandular, adaxial faces glabrous, eglandular. Disc florets 100-250+, bisexual, fertile; corollas yellow, cylindric to cylindric campanulate, 5.7-7.4  $\times$  0.7-0.9 mm, lobes 5, glabrous or sparsely pubescent, eglandular. Receptacles hemispheric to globose to ovoid, paleae none. Cypselsae narrowly obpyramidal, 4.2-4.7  $\times$  0.9-1.2 mm, densely pubescent with straight, forked, antrorse hairs, eglandular; pappi 9-11(-15), obovate- to oblanceolate-aristate, 4.7-7.3  $\times$  0.7-1.3 mm. Chromosome number,  $2n = 30$ .

*Flowering and Distribution.*—Flowering May to June. Roadsides, edges of juniper-pine and pine forests, 1375-2470 m. Central to eastern Arizona and western New Mexico (Fig. 1).

Representative specimens examined. **UNITED STATES. ARIZONA. Apache Co.:** 7 mi N of hwy 264 on rd to Sawmill, 24 Jun 1965, *Strother* 402 (TEX). **Coconino Co.:** Hwy 89, ca 13 mi N of IH 40 (jet in Flagstaff) at turnoff to Sunset Crater National Monument, 20 May 1989, *Bierner* 89-25 (ARIZ, TEX); 7 mi NE of Strawberry, 29 May 1966, *Lehto* 6311 (ASU); 26 mi E of Strawberry,  $2n = 30$ , 16 Jun 1947, *Parker & McClintock* 6851 (ARIZ); ca 10 mi S of Flagstaff on hwy 79, 14 Jun 1965, *Strother* 339 (TEX). **Gila Co.:** Barnhart Pass, Mazatzal Mts, 15 May 1935, *Collom* 299 (ARIZ); 20 mi SW of Young, Sierra Ancha Mts, 1 May 1947, *Parker* 531 (ARIZ); 5 mi N of Young, Pleasant Valley, 14 Jun 1947, *Parker & McClintock* 6692 (ARIZ, TEX). **Greenlee Co.:** 20 mi N of Clifton, 7 Jun 1935, *Maguire* et al. 11865 (ARIZ).

**Navajo Co.:** Hwy 60, 12.8 mi SW of hwy 260 (jet in Show Low), 2n = 1511, 19 May 1988, *Biernier* 88-54 (ARIZ, TEX); Lakeside, White Mts. 9 Jun 1928, *Harrison* 5467 (ARIZ, LL). **Pima Co.:** 3 mi up Mt. Lemon Rd past entrance sign to Coronado Forest. 31 May 1967, *Mears* 1663b (TEX). **NEW MEXICO. Catron Co.:** just W of Luna, 23 Jun 1965, *Strother* 394 (TEX) **Cibola Co.:** Near Bluewater Canyon Dam, 12 mi S of Bluewater, 20 May 1936, *Parker & Parker* 3481 (ARIZ). **Grant Co.:** near Santa Rita Copper Mines (Santa Rita del Cobre), 22 mi E of Silver City, 18 May 1936, *Parker & Parker* 3452 (ARIZ).

*Note.*—More than 70 specimens were examined for this treatment. Those listed above were chosen as representative of the geographic distribution and morphologic variation of *Hymenoxys bigelovii*.

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#### REFERENCES

- BEAMAN, J.H. and B.L. TURNER. 1962. Chromosome numbers in Mexican and Guatemalan Compositae. *Rhodora* 64:271–276.
- BIERNER, M.W. 2001. Taxonomy of *Hymenoxys* subgenus *Picradenia* and a conspectus of the subgenera of *Hymenoxys* (Asteraceae: Helenieae: Tetraneurinae). *Lundellia* 4:37–63.
- BIERNER, M.W. and R.K. JANSEN. 1998. Systematic implications of DNA restriction site variation in *Hymenoxys* and *Tetraneuris* (Asteraceae, Helenieae, Gaillardiiinae). *Lundellia* 1:17–26.
- BIERNER, M.W. and B.L. TURNER. 2003. Taxonomy of *Tetraneuris* (Asteraceae: Helenieae: Tetraneurinae). *Lundellia* 6:44–96.
- COCKERELL, T.D.A. 1904. The North American species of *Hymenoxys*. *Bull. Torrey Bot. Club* 31:461–509.
- GRAY, A. 1853. *Plantae Wrightianae Texano-Neo-Mexicanae*: an account of a collection of plants made by Charles Wright, A.M., in an expedition from Texas to New Mexico, in the summer and autumn of 1849, with critical notices and characters of other new and interesting plants from adjacent regions, &c. 2:96. Smithsonian Institution, Washington.
- GRAY, A. 1883. I. Contributions to North American botany. I. Characters of new Compositae, with revisions of certain genera, and critical notes. *Proc. Amer. Acad. Arts* 18:1–73.
- HELLER, A.A. 1898. New and interesting plants from western North America.—IV. *Bull. Torrey Bot. Club* 25:626–629.
- KARIS, P.O. and O. RYDING. 1994. Tribe Helenieae. In: K. Bremer, ed. *Asteraceae: cladistics & classification*. Timber Press, Portland, Oregon. Pp. 521–558.
- ROBINSON, H. 1981. A revision of the tribal and subtribal limits of the Heliantheae (Asteraceae). *Smithsonian Contr. Bot.* 51:1–102.
- RYDBERG, P.A. 1915. *Macdougalia*. *North American Flora* 34:109–110. The New York Botanical Garden, New York.

- SANDERSON, S.C. 1973. In: IOPB chromosome number reports XL. *Taxon* 22:285–291.
- SPEESE, B.M. and J.T. BALDWIN. 1952. Chromosomes of *Hymenoxys*. *Amer. J. Bot.* 39:685–688.
- SPRING, O., B. ZITTERELL-HAID, M.W. BIERNER, and T.J. MABRY. 1994. Chemistry of glandular trichomes in *Hymenoxys* and related genera. *Biochem. Syst. Ecol.* 22:171–195.
- STROTHER, J.L. 1966. Chromosome numbers in *Hymenoxys* (Compositae). *Southw. Naturalist* 11:223–227.
- TORREY, J. and A. GRAY. 1842. A flora of North America: containing abridged descriptions of all the known indigenous and naturalized plants growing north of Mexico; arranged according to the natural system. 2(2):381–383. Wiley & Putnam, New York.
- TURNER, B.L. and A.M. POWELL. 1977. Helenieae—systematic review. In: V.H. Heywood, J.B. Harborne, and B.L. Turner, eds. *The biology and chemistry of the Compositae*. Academic Press, London. Pp.699–737.
- TURNER, B.L., A.M. POWELL, and T.J. WATSON. 1973. Chromosome numbers in Mexican Asteraceae. *Amer. J. Bot.* 60:592–596.
- WAGNER, H., M.A. IYENGAR, L. HORHAMMER, and W. HERZ. 1972. Flavonol-3-glycosides in eight *Hymenoxys* species. *Phytochemistry* 11:3087–3088.